

[Title of the Document] SCOPE OF CLAIM FOR PATENT

[Claim 1]

An intake air amount control system for an internal combustion engine, which variably controls an amount of intake air drawn into a cylinder via a variable intake valve timing device that changes valve timing of an intake valve, as desired, comprising:

estimated intake air amount-calculating means for calculating an estimated intake air amount as an estimated value of the amount of intake air drawn into the cylinder;

target intake air amount-setting means for setting a target intake air amount as a target to which the intake air amount is to be controlled;

identification means for identifying, based on a controlled object model to which a control command value for controlling the variable intake valve timing device is inputted and from which the estimated intake air amount is outputted, all model parameters of the controlled object model, with a predetermined identification algorithm;

control command value-calculating means for calculating the control command value based on the identified all model parameters such that the estimated intake air amount converges to the target intake air amount; and

control means for controlling the variable intake valve timing device according to the calculated control command value.

[Claim 2]

An intake air amount control system as claimed in claim 1, wherein said control command value-calculating means calculates a predicted value of the estimated

intake air amount, with a predetermined prediction algorithm, and calculates the control command value further based on the predicted value of the estimated intake air amount.

[Claim 3]

An intake air amount control system as claimed in claim 2, wherein said control command value-calculating means calculates the control command value further with a predetermined response-specifying control algorithm.

[Claim 4]

An intake air amount control system as claimed in claim 1, wherein the variable intake valve timing device comprises:

- an intake rocker arm that pivotally moves to thereby actuate the intake valve for opening and closing thereof;

- a movable pivot that pivotally movably supports said intake rocker arm;

- first and second intake camshafts that rotate at the same rotational speed;

- a variable intake cam phase mechanism that changes a relative phase between the first and second intake camshafts;

- a first intake cam that is provided on said first intake camshaft, for rotation along with rotation of said first intake camshaft to thereby pivotally move said intake rocker arm about said pivot; and

- a second intake cam that is provided on said second intake camshaft, for rotation along with rotation of said second intake camshaft to thereby move said pivot of said intake rocker arm.

[Claim 5]

An intake air amount control system as claimed in

claim 3, wherein the variable intake valve timing device comprises:

an intake rocker arm that pivotally moves to thereby actuate the intake valve for opening and closing thereof;

a movable pivot that pivotally movably supports said intake rocker arm;

first and second intake camshafts that rotate at the same rotational speed;

a variable intake cam phase mechanism that changes a relative phase between the first and second intake camshafts;

a first intake cam that is provided on said first intake camshaft, for rotation along with rotation of said first intake camshaft to thereby pivotally move said intake rocker arm about said pivot; and

a second intake cam that is provided on said second intake camshaft, for rotation along with rotation of said second intake camshaft to thereby move said pivot of said intake rocker arm.

[Claim 6]

An intake air amount control system as claimed in claim 4, wherein said variable intake cam phase mechanism is formed by a hydraulically-driven variable intake cam phase mechanism that is driven by supply of oil pressure, and

wherein said control means controls oil pressure supplied to said hydraulically-driven variable intake cam phase mechanism.

[Claim 7]

An intake air amount control system as claimed in claim 5, wherein said variable intake cam phase mechanism is formed by a hydraulically-driven variable

intake cam phase mechanism that is driven by supply of oil pressure, and

wherein said control means controls oil pressure supplied to said hydraulically-driven variable intake cam phase mechanism.

[Claim 8]

An intake air amount control system for an internal combustion engine, which variably controls an amount of intake air drawn into a cylinder via a variable intake valve timing device that changes valve timing of an intake valve, as desired, comprising:

estimated intake air amount-calculating means for calculating an estimated intake air amount as an estimated value of the amount of intake air drawn into the cylinder;

target intake air amount-setting means for setting a target intake air amount as a target to which the intake air amount is to be controlled;

predicted value-calculating means for calculating a predicted value of the estimated intake air amount with a predetermined prediction algorithm;

control command value-calculating means for calculating the control command value such that the estimated intake air amount converges to the target intake air amount, according to the predicted value of the estimated intake air amount; and

control means for controlling the variable intake valve timing device according to the calculated control command value.

[Claim 9]

An intake air amount control system as claimed in claim 8, wherein said control command value-calculating means calculates the control command value further with

a predetermined response-specifying control algorithm.
[Claim 10]

An intake air amount control system as claimed in claim 8, wherein the variable intake valve timing device comprises:

an intake rocker arm that pivotally moves to thereby actuate the intake valve for opening and closing thereof;

a movable pivot that pivotally movably supports said intake rocker arm;

first and second intake camshafts that rotate at the same rotational speed;

a variable intake cam phase mechanism that changes a relative phase between the first and second intake camshafts;

a first intake cam that is provided on said first intake camshaft, for rotation along with rotation of said first intake camshaft to thereby pivotally move said intake rocker arm about said pivot; and

a second intake cam that is provided on said second intake camshaft, for rotation along with rotation of said second intake camshaft to thereby move said pivot of said intake rocker arm.

[Claim 11]

An intake air amount control system as claimed in claim 9, wherein the variable intake valve timing device comprises:

an intake rocker arm that pivotally moves to thereby actuate the intake valve for opening and closing thereof;

a movable pivot that pivotally movably supports said intake rocker arm;

first and second intake camshafts that rotate at

the same rotational speed;

a variable intake cam phase mechanism that changes a relative phase between the first and second intake camshafts;

a first intake cam that is provided on said first intake camshaft, for rotation along with rotation of said first intake camshaft to thereby pivotally move said intake rocker arm about said pivot; and

a second intake cam that is provided on said second intake camshaft, for rotation along with rotation of said second intake camshaft to thereby move said pivot of said intake rocker arm.

[Claim 12]

An intake air amount control system as claimed in claim 10, wherein said variable intake cam phase mechanism is formed by a hydraulically-driven variable intake cam phase mechanism that is driven by supply of oil pressure, and

wherein said control means controls oil pressure supplied to said hydraulically-driven variable intake cam phase mechanism.

[Claim 13]

An intake air amount control system as claimed in claim 11, wherein said variable intake cam phase mechanism is formed by a hydraulically-driven variable intake cam phase mechanism that is driven by supply of oil pressure, and

wherein said control means controls oil pressure supplied to said hydraulically-driven variable intake cam phase mechanism.

[Claim 14]

A control system for controlling a plant, comprising:

output detecting means for detecting an output from the plant;

target value-setting means for setting a target value of the output from the plant; and

prediction means for predicting a predicted value of the output from the plant, with a predetermined prediction algorithm which is derived based on a controlled object model of the plant and defines a relationship between an input to the plant, the output, and the predicted value of the output from the plant,

wherein the predetermined prediction algorithm includes a plurality of predictive coefficients, the predictive coefficients including a compensation parameter for compensating for a steady-state deviation between the predicted value of the output from the plant and the output from the plant, as one of an addition term and a subtraction term,

the control system further comprising:

identification means for identifying the predictive coefficients with a predetermined identification algorithm such that a difference between the predicted value of the output from the plant and the detected output from the plant becomes minimum; and

control command value-determining means for determining a control command value for controlling an input to the plant, based on the identified predictive coefficients with a predetermined control algorithm such that the detected output from the plant converges to the set target value.

[Claim 15]

A control system as claimed in claim 14, wherein the predetermined control algorithm is a predetermined response-specifying control algorithm.

[Claim 16]

A control system as claimed in claim 15, wherein with the predetermined response-specifying control algorithm, the control command value is determined as a total sum of a plurality of command value components, and

wherein the command value components include a selection command value component for selecting, when there are two solutions to the command control value, one of the two solutions.

[Claim 17]

A control system for variably controlling an amount of intake air drawn into a cylinder of an internal combustion engine via a variable intake valve timing device that changes valve timing of an intake valve, as desired, comprising:

cylinder intake air amount-detecting means for detecting a cylinder intake air amount as an amount of intake air drawn into the cylinder;

target value-setting means for setting a target value of the cylinder intake air amount; and

prediction means for predicting a predicted value of the cylinder intake air amount, with a predetermined prediction algorithm that is derived based on a controlled object model to which a value indicative of valve timing of the intake valve is inputted, the value being set by the variable intake valve timing device, and from which the cylinder intake air amount is outputted, and defines a relationship between the value indicative of the valve timing of the intake valve, the cylinder intake air amount, and the predicted value of the cylinder intake air amount,

wherein the predetermined prediction algorithm

includes a plurality of predictive coefficients, the predictive coefficients including a compensation parameter for compensating for a steady-state deviation between the predicted value of the cylinder intake air mount and the cylinder intake air amount, as one of an addition term and a subtraction term,

the control system further comprising:

identification means for identifying the predictive coefficients with a predetermined identification algorithm such that a difference between the predicted value of the cylinder intake air mount and the detected cylinder intake air mount becomes minimum; and

control command value-determining means for determining a control command value for controlling the variable intake valve timing device based on the identified predictive coefficients with a predetermined control algorithm such that the detected cylinder intake air mount converges to the set target value.

[Claim 18]

A control system as claimed in claim 17, wherein the predetermined control algorithm is a predetermined response-specifying control algorithm.

[Claim 19]

A control system as claimed in claim 18, wherein with the predetermined response-specifying control algorithm, the control command value is determined as a total sum of a plurality of command value components, and

wherein the command value components include a selection command value component for selecting, when there are two solutions to the command control value, one of the two solutions.